

**Course Name:** Refinery System Process Analysis & Testing using Agent Based Simulation

**Reference Code:** Gas 702

### About the course:

A typical medium-size refinery has hundreds of pumps, heat exchangers and drums; dozens of furnaces, compressors, and high temperature/high pressure reactors; and thousands of control loops and associated computer control technologies. In order to optimize these complex systems and their interactions approach to single point or single system optimizing cannot work as effectively as we hope, as the refinery has to be considered as a system, rather than connection of its parts. Here is where the multi-method simulation comes to play an important part, as we can use Discrete Event, Agent Based and System Dynamics simulation to incorporate all the refinery systems into one and be able to have the outputs from the system, as well as its components, rather than just having an output from one of the components

### Course Objective:

At the end of this training course, participants will have learned about:

- Learn the concepts and methods of selecting feedstocks and product slates
- Understand the capabilities of AnyLogic as multi-method simulation tool
- Acquire the knowledge to consider the refinery as a system, not a sum off its parts
- Incorporate optimizing models into a simulation package
- Create and run simulations of complex systems
- Harness the possibilities of testing change options in virtual environment

### Who Should attend?.

- Process engineers
- Refinery schedulers
- Planners and managers
- Data Scientists
- Data Analysts
- Petroleum engineers
- Refinery Plant Engineers

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## Course Methodology:

This training course is designed to be a hands-on, stimulating experience. The training course is highly interactive with many discussion and practice sessions.

- Relevant computer simulations and videos .
- Copies of all presentation material.
- Variety of Learning Methods.
- Pre-test and final test.
- Case Study
- Training Groups.
- Presentation.
- Lectures

## Course Outline:

### Day One: Refinery Process

- Basics of Petroleum refining industry
- Refinery Configuration
  - Distillation Processes
  - Coking and Thermal Processes
  - Catalytic Processes
  - Cracking Processes
  - Alteration Processes
  - Treatment Processes
  - Product Blending
- Mathematical Programming in Refining

### Day Two: Multi-method Simulation

- Discrete Event Simulation Modeling
- System Dynamics Simulation Modeling
- Agent Based Simulation Modeling
- Introduction to AnyLogic software
- Exercise: First model development in AnyLogic software
- Multi-method modeling and its application to refinery process
- Exercise: Multi-model creation in AnyLogic

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#### Day Three: Petroleum Refinery Planning

- Characterization, Physical and Thermodynamic Properties of Oil Fractions
- Crude Assay
  - Bulk properties
  - Fraction properties
- Regression-Based Planning
- Artificial-Neural-Network-Based Modeling
- Exercise: using fluid library in AnyLogic

#### Day Four: Planning Under Uncertainty for a Single Refinery

- Deterministic Model Formulation
- Stochastic Model Formulation
- Sampling Methodology
- Objective Function Evaluation
- Variance Calculation
- Demand Uncertainty
- Process Yield Uncertainty
- Variation Coefficient
- Exercise: Refinery plant model creation in AnyLogic

#### Day Five: Integration with Petrochemical Supply Chain

- Refinery and Petrochemical Synergy Benefits
- Delivery of crude oil to refinery
- Exercise: Connecting the delivery process with refinery process
- Exercise: Calculating outputs and statistics
- Exercise: Optimization results of the system as a whole
- Areas of application for multi-method-based simulation
  
- Metallurgy

**Time: 08:00 AM -03:00 PM Numbers of hours: 35 Hours**

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